
A New Species of *Phegopteris* (Thelypteridaceae) from Korea

Chul Hwan Kim and Byung-Yun Sun*

Faculty of Biological Sciences, Chonbuk National University, Chonju, Chonbuk 561-756, Korea. plantaxa@hanmail.net; *author for correspondence: sunby@chonbuk.ac.kr

Soo Hyun Park

The National Arboretum, Jikdong-ri 51-7, Sohul-myon, Pochun-gun, Gyunggi 487-821, Korea. natpark@hanmail.net

ABSTRACT. A new species of fern, *Phegopteris koreana* (Thelypteridaceae), was collected from southern Korea and is described here. *Phegopteris koreana* is most similar to *P. decursive-pinnata* morphologically; however, the new species consistently shows discontinuous morphological gaps from the latter in the shape of the fronds, pinnae, and ultimate segments, venation pattern in ultimate segments, tufted trichomes in the sori, and spore wall sculpturing.

Key words: Korea, *Phegopteris*, Thelypteridaceae.

Thelypteridaceae Ching ex Pichi Sermolli are one of the largest families of ferns, comprising ca. 900 species mostly distributed in tropical regions (Grimes & Parris, 1986). The family is highly problematic, and there has been much confusion in the taxonomy of the family (Iwatsuki, 1965; Smith, 1990). The circumscription of genera varies greatly according to different authors, ranging from the recognition of only one genus, *Thelypteris* Schmidel, in the broadest sense to segregating ca. 30 genera by Holttum (1969, 1971, 1982). Most authors, however, agree that *Phegopteris* (C. Presl) Fée is one of the most distinctive elements in the family by the presence of wings on the rachis and recognize it as a distinct genus (Grimes & Parris, 1986; Smith, 1990, 1993; Shing et al., 1999).

Phegopteris is a small genus of only five species (including the new one described here) in temperate regions of the Northern Hemisphere in eastern Asia and North America. It is well distinguished from other genera of Thelypteridaceae by wings on the rachis, the wings uniting adjacent pinnae, the costae lacking an adaxial groove, the naked sori, and fronds lacking septate trichomes (Grimes & Parris, 1986; Smith, 1990, 1993; Shing et al., 1999). Among the species, *P. connectilis* (Michaux) Watt usually occurs in cool to cold climate regions and on mountains or in alpine regions in China,

Japan, Korea, Russia (Siberia), Taiwan, North America, and northern Europe, whereas *P. decursive-pinnata* (H. C. Hall) Fée occurs mainly at low elevations in eastern Asia, including China, India, Indonesia, Japan, Korea, Indochina, and Taiwan. In contrast to the wide distribution ranges of those two species, *P. hexagonoptera* (Michaux) Fée is confined to southeastern North America, and *P. tibetica* Ching is restricted to high elevations in Xizang, China (Iwatsuki, 1965; Park, 1975; Smith, 1993; Shing et al., 1999).

During compilation of the fern flora of Korea, we found ferns that clearly belong to *Phegopteris*, but which cannot be placed within any of the known species. It is here described.

Phegopteris koreana B.-Y. Sun & C. H. Kim, sp. nov. TYPE: Korea. Jeollanam-do Province: Mt. Baekyang, under the edge of deciduous forest, partially shaded, 13 Oct. 2001, Sun B.-Y. & C. H. Kim 434 (holotype, JNU; isotypes, JNU). Figure 1.

Korean name: Keun-seol-seol-go-sa-ri.

Haec species quoad rhizoma breve erectum vel adscendens etiam frondes caespitosas lamina ambitu lanceolata latitudinem maximam ad medium attingente ad *P. decursive-pinnata* maxime accedit, sed ab ea frondis lamina uni- vel bipinnata pinnis profunde pinnatisectis vel pinnatis, pinnulis vel segmentis crenato-lobatis latitudinem maximam ad medium attingentibus, pinnularum (vel segmentorum) venulis 1- ad 3-furcatis, capsula sporangiali setis usque ad 0.5 mm longis ornata atque sporis tuberculatis distinguitur.

Plants terrestrial, green in summer; rhizomes short, erect or ascending. Fronds monomorphic, clustered, 50–80 cm long; stipes 10–20 cm long, densely scaly at base, sparsely scaly elsewhere; scales 4–8 × 0.4–0.6 mm, linear-lanceolate, membranaceous, dark brown, margins setiferous; blades herbaceous, elliptic, broadest at middle portion, gradually narrowed toward caudate apex and blade

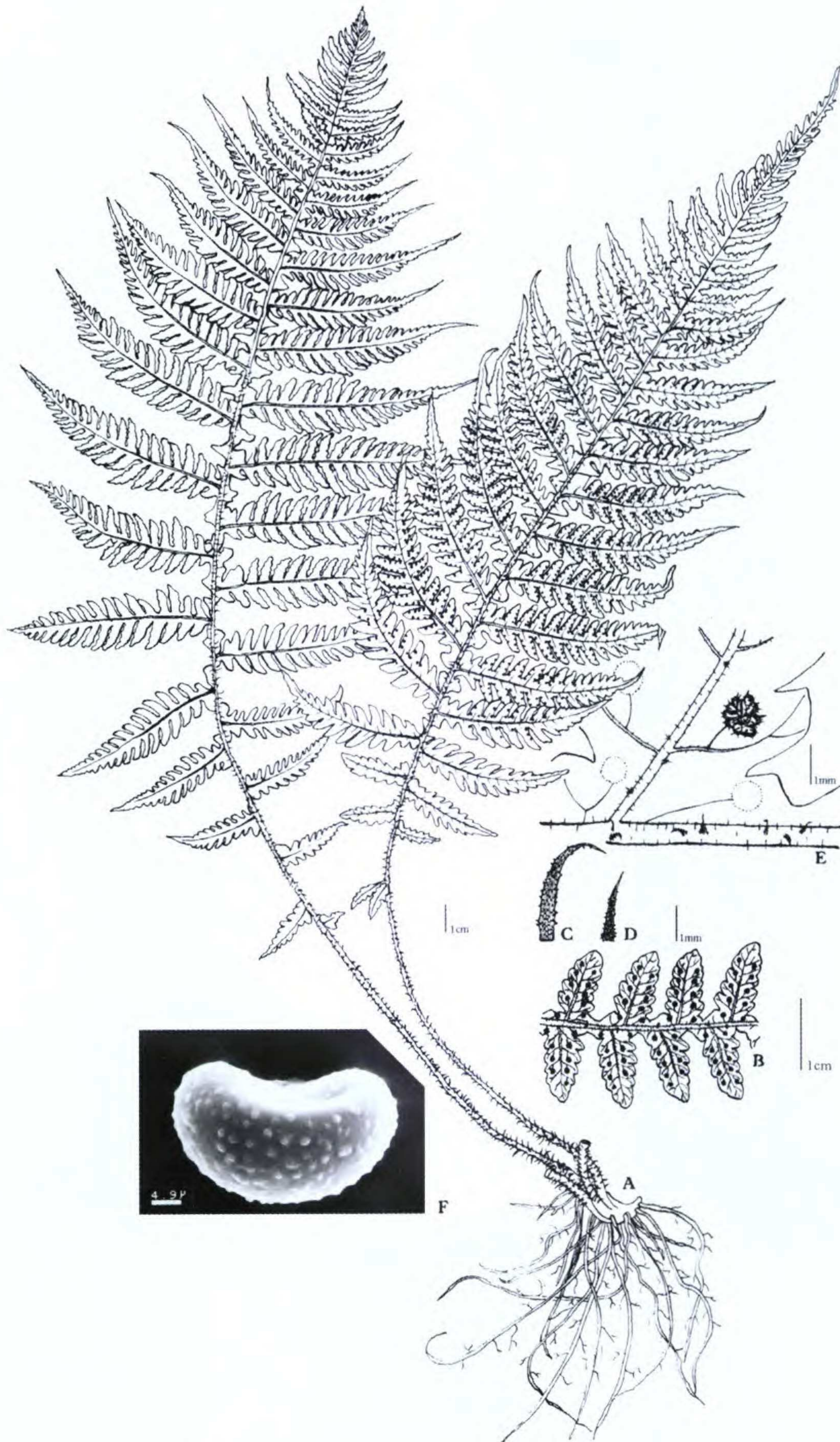


Figure 1. *Phegopteris koreana* B.-Y. Sun & C. H. Kim. —A. Habit. —B. Pinnae-pinnules or lobes with veinlets and sori. —C. Scale from stipe base. —D. Scale from rachis. —E. Sorus with hairs. —F. SEM microphotograph of spore. All are drawn from holotype, Sun, B.-Y. & C. H. Kim 434 (JNU).

base, 40–60 cm long, 20–30 cm wide at middle, 1-pinnate with deeply pinnatisect pinnae or 2-pinnate; rachises winged by continuation of dilated (auricled) bases of pinnae, glabrous or sparsely pu-

bescent, sparsely scaly; pinnae 5–13 × 1.5–2.5 cm at middle, gradually reduced in size toward base and apex, ca. 20 pairs, alternate, broadest at middle, narrowly elliptic, deeply pinnatisect or pinnate,

connected to adjacent pinnae by rachis wing except near basal ones, apex acuminate or caudate, sparsely pubescent and scaly; pinnules or pinnatisect segments in 15 to 20 pairs, nearly opposite, acute or obtuse, lobed-crenate; veins free, not reaching margins, generally forked 2 or 3 times on pinnules or pinnatisect segments. Sori round, nearly medial in 1 row, generally subterminal on the veins, with trichome tufts on the receptacles, which are less than 0.5 mm long; sporangial capsules sparsely setiferous, to 0.5 mm long, with sparse, stalked glandular trichomes; indusia lacking. Spores monolete, bilateral, tuberculate. Chromosome number $2n = 120$.

The principal attributes distinguishing *Phegopteris koreana* from *P. decursive-pinnata* are in characteristics of the fronds and in such micromorphological characters as the length of trichome tufts on the sori and in the spore wall sculpturing. *Phegopteris koreana* usually has fronds 50–80 cm long and 20–30 cm wide at the middle, while *P. decursive-pinnata* usually has smaller fronds, 20–60 cm long and 5–15 cm wide. Although both species have once-pinnate blades, the pinnae are basically different. The pinnae of *P. koreana* are deeply pinnatisect, and hence the fronds are bipinnatisect, or appear to be twice-pinnate. In contrast, the pinnae of *P. decursive-pinnata* are pinnatifid in the middle (and hence the fronds are bipinnatifid), and shallowly pinnatifid to lobed or crenate toward the base and apex. The shape of pinnae also differs. In *P. koreana*, the middle part is the broadest and hence the pinnae are narrowly elliptic. In *P. decursive-pinnata*, the margins are parallel and hence the pinnae are oblong except for the caudate apex. Each pinnule or pinnatisect segment (i.e., ultimate segment) of *P. koreana* is crenate, whereas the ultimate segments of *P. decursive-pinnata* are usually entire to subentire. The two species have trichome tufts on the receptacle of the sori, which are shorter, less than 0.5 mm long in *P. koreana*, and more than 0.5 mm long in *P. decursive-pinnata*. The venation pattern in ultimate segments also readily distinguishes the two species. In *P. koreana*, each pinnule or pinnatisect segment has veins that fork 2 or 3 times; in *P. decursive-pinnata* the ultimate segments have veins that are usually simple or rarely fork twice.

The spore wall sculpturing is different in the two species: the tubercles are well developed and relatively large in *P. koreana* (Fig. 1F), whereas the tubercles are nearly lacking or rarely are small and poorly developed in *P. decursive-pinnata*, as described by Tryon and Lugardon (1991).

Iwatsuki (1965) commented that *P. decursive-pinnata* is variable in the size and form of the fronds and cited a herbarium specimen (*Chou 382*) collected in Korea that showed bipinnatisect fronds more than 65 cm long. He treated this as a form of *P. decursive-pinnata*. However, in our comparative study of herbarium specimens collected from China, Japan, and Korea, this large, bipinnatisect or twice-pinnate form consistently differs from *P. decursive-pinnata* in the shape of the fronds, pinnae, and ultimate segments, tufted trichomes in the sori, and spore wall sculpturing. We therefore treat this specimen and similar plants as comprising a new species.

Paratypes. KOREA. **Jeollabuk-do:** Sunchang-gun, Mt. Hoemun, 1 Oct. 1997, *Hwang, Y. M. & Y. J. Ko s.n.* (JNU), *Rhyu, H. J. & B. R. Kang s.n.* (JNU); Temple Bogwangsa, 2 Sep. 1973, *T. B. Lee s.n.* (SNUA [4]); Mt. Naejang, 7 Aug. 1974, *T. B. Lee s.n.* (SNUA [2]). **Jeollanam-do:** Mt. Suin, near Castle Suin, 16 May 2003, *Sun, B. Y. s.n.* (JNU); Gwangyang-gun, Jinsang-myeon, Eochi-ri, 27 Aug. 2001, *Park, S. H. et al. s.n.* (JNU).

KEY TO THE SPECIES OF *PHEGOPTERIS* IN THE WORLD

- 1a. Rhizomes long creeping; fronds distantly spaced; blades deltate or nearly so, broadest at or near base.
 - 2a. Basal pair of pinnae connected to those next above by wing along rachis . . . *P. hexagonoptera*
 - 2b. Basal pair of pinnae not connected to those next above by wing along rachis.
 - 3a. Blades 8–23 × 6–20 cm, deltate; basal pair of pinnae slightly longer than broad *P. connectilis*
 - 3b. Blades 18–20 × 10–14 cm, narrowly deltate; basal pair of pinnae 2 times longer than broad *P. tibetica*
- 1b. Rhizomes short, erect or ascending; fronds clustered; blades lanceolate, broadest at middle.
 - 4a. Blades 1-pinnate, pinnae lobed or pinnatifid, nearly parallel from base to middle, pinnules nearly entire; veinlets of pinnules simple, 1- or rarely 2-forked; setae on sporangial capsules 0.5–0.8 mm long; spore walls smooth, rarely with a few tubercles *P. decursive-pinnata*
 - 4b. Blades 1-pinnate; pinnae deeply pinnatisect or blades 2-pinnate, broadest at middle, pinnules lobed-crenate; veinlets of pinnules 1- to 3-forked; setae on sporangial capsules to 0.5 mm long; spore walls tuberculate *P. koreana*

Acknowledgments. This research was supported in part by a grant from the Eco-technopia21 Project of Environmental Technology Development funded by the Ministry of Environment of the Korean Government in 2003. Many thanks to A. R. Smith for commenting on and improving the manuscript. The authors also thank D. E. Boufford for improving the

manuscript, and the directors of the following herbaria for the loan of specimens: PE, SNU, SNUA.

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